NATIONAL MARROW DONOR PROGRAM®

Entrusted to operate the C.W. Bill Young Cell Transplantation Program,
including Be The Match Registry®

August 09, 2012

CDR Sheri Parker
Office of Naval Research (ONR 342)
875 N. Randolph St.
Arlington, VA 22203-1995

Subject: **Final Performance/Technical Report of the National Marrow Donor Program®**

Reference: Grant Award #N00014-10-1-0834 between the Office of Naval Research and the National Marrow Donor Program

Dear CDR Parker:

In accordance with the requirements of the Referenced Cooperative Agreement, the enclosed subject document is provided as the Final Performance/Technical Report for the statement of work associated with the Grant for the period of June 01, 2010 through February 28, 2011.

With this submittal of the Final Report, the National Marrow Donor Program has satisfied the all reporting requirements of the above referenced Grant.

Should you have any questions as to the scientific content of the tasks and the performance activity of this progress report, you may contact our Chief Medical Officer – Dennis Confer, MD directly at 612-362-3425.

Please direct any questions pertaining to the Grant to my attention (612-362-3403) or at cabler@nmdp.org.

Sincerely,

Carla Abler-Erickson

Carla Abler-Erickson, MA
Contracts Manager

Enclosure: Quarterly Report with SF298

C: D. Ivery – ACO (ONR-Chicago)
Dr. Robert J. Hartzman, CAPT, MC, USN (Ret)
Jennifer Ng, PhD – C.W. Bill Young Marrow Donor Recruitment and Research Program
J. Rike - DTIC (Stc 0944): letter and enclosure
NRL (Code 5227): letter and enclosure
Dennis Confer, MD, Chief Medical Officer, NMDP
Roberta King, NMDP
Colleen O'Neil, NMDP

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Washington Headquarters Service, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington, DC 20503.
PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
09-08-2012	Final	Jun 2010 – February 2011

4. TITLE AND SUBTITLE
Development of medical Technology for Contingency Response to Marrow Toxic Substances – Final Performance/Technical Report for June 01, 2010 to February 28, 2011

5a. CONTRACT NUMBER
N/A

5b. GRANT NUMBER
N00014-10-1-0834

5c. PROGRAM ELEMENT NUMBER
N/A

6. AUTHOR(S)
O'Neil, Colleen

5d. PROJECT NUMBER
N/A

5e. TASK NUMBER
Project 1

5f. WORK UNIT NUMBER
N/A

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
National Marrow Donor Program
3001 Broadway St., N.E., Ste. 500
Minneapolis, MN 55413

8. PERFORMING ORGANIZATION REPORT NUMBER
N/A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Office of Naval Research
875 N. Randolph St.
Arlington, VA 22203

10. SPONSOR/MONITOR'S ACRONYM(S)
ONR

11. SPONSORING/MONITORING AGENCY REPORT NUMBER
N/A

12. DISTRIBUTION AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited

13. SUPPLEMENTARY NOTES
N/A

14. ABSTRACT
The purpose of this effort is to provide support for high priority efforts that will:

- Reduce the data collection burden at centers.
- Provide additional functionality to capture and report critical cord blood information.
- Enhance the user experience within FormsNet2 (FN2).
- Provide better access to hematopoietic cell transplant (HCT) operational, research and management data for the NMDP and CIBMTR, partner registries, participating Donor and HVT centers and the interested public.

15. SUBJECT TERMS
FormsNet Enhancement to Improve Functionality

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE	Same as Report	10	Dennis L. Confer, MD – Chief Medical Office
U	U	U			19b. TELEPONE NUMBER (*Include area code*) 612.362.3425

NATIONAL MARROW DONOR PROGRAM®

BE THE MATCH®

Development of Medical Technology for Contingency Response To Marrow Toxic Agents

FINAL PERFORMANCE/TECHNICAL REPORT

June 01, 2010 – February 28, 2011

Center for International Blood and Marrow Transplant Research (CIBMTR) Information Technology (CIT) Project

Overview:

The purpose of this funding request was to provide support for high priority efforts that will:

- Reduce the data collection burden at centers.
- Provide additional functionality to capture and report critical cord blood information.
- Enhance the user experience within FormsNet2 (FN2).
- Provide better access to hematopoietic cell transplant (HCT) operational, research and management data for the NMDP and CIBMTR, partner registries, participating Donor and HCT centers and the interested public.

Grant Period: June 1, 2010 – November 30, 2010 (Extended to February 28, 2011)

Reporting period: June 1, 2010 – February 28, 2011

Accomplishments:

- **<u>CIT MSP Operational Support for Cord Blood Centers</u>**
  - **All open tickets associated with Cord Blood issues within the FormsNet application have either been completed and closed or analyzed and scheduled for a future release.**

Substantial progress was made in 2010 to consolidate legacy NMDP and CIBMTR databases and improve integration with other NMDP data sources. When complete, the effort to produce datasets will be reduced and there will be improved quality and completeness of data made available to statisticians, Centers and Cord Blood Banks. Project completion is anticipated in 2011.

Considerable effort was expended during the grant period to enhance reports provided to Cord Blood Banks and to increase the completeness of data available from Transplant Centers on procedures using cord blood products. Improvements have been confirmed by the Cord Blood Banks as evidenced by a survey of banks conducted by CIBMTR in summer 2010. Results indicate CIBMTR has been responsive to their needs and 80% feel that variables now provided by CIBMTR in the cord blood bank outcomes reports meet their data needs. Some key changes to this report are as follows:

- Now designed to address banks' internal quality assurance processes and reporting requirements for regulatory and accreditation purposes;
- Now includes chimerism data along with functionality to identify items on reports that have changed in comparison to their most recent outcomes report;
- Now following a monthly (vs. quarterly) distribution schedule.

Future enhancements have been evaluated, and providing XML data to Cord Blood Banks has been designated highest priority. Evaluation and possible deployment of caAERS (caBIG® Adverse Event Reporting System; part of the NCI "cancer Biomedical Informatics Grid", or caBIG®, project) is in process.

- **FormsNet Engine Redesign to Reduce Data Collection Burden at the Centers and to Enhance the User Experience within FormsNet**

This 2012 planned upgrade to FormsNet2 to FormsNet3, will replace the technical foundation of the current FN2 application, with more agile, efficient & effective systems. It will enhance the user experience by providing enhanced functionality (defined by the network users). The top objectives are:

  - Enhance Performance – i.e., improve speed, usability, consistency and usefulness of forms access, user data entry, and validations
  - Improve user experience/usability – e.g., offer real-time data validations, rules, control of data entry "flow", error handling and messaging, and "smart navigations" (from form-to-form or from field-to-field on the same form), auto population of key fields
  - Improve data quality- enable data entry to be as easy, consistent, accurate, and fast as possible
  - Productivity / Process Improvement - decrease the time it takes to add a new form or add a validation. Release an application module without requiring a release to other application modules.

The FN3 core application redesign initiative is currently in the design phase and the CIT team is collaborating with the CIBMTR business partners and network users to ensure additional user input and review. An FN3 network partners review team is managed by the FN2 super users who serve as liaisons to the development team.

COMPLETED:

- Proof-of-concept (POC) for the engine design was successfully completed by August 2010
    - Prove that the overall performance and validation of form data can be improved utilizing newer technologies.
    - Refactor the current web application to make use of best practices.
    - To show how a newer version of the FormsNet web application may provide a more user-friendly experience.
    - Created technical design document to be used for development.
- The first production release using the FormsNet3 design was February 2011. Recipient Audit functionality was added to the FormsNet application suite.
- An architectural review of the approach and proposed design were conducted during the grant period resulting in a streamlined, lower maintenance and a more extensible development approach.

Planned Activity:

- Activity on this efforts extends past the grant period with proposed funding from the FY12 2.D.1.1. submittal.
- Donor Audit functionality is planned for release in the FN3 redesign during June 2011.

- **Provide better access to hematopoietic cell transplant (HCT) operational, research and management data for the NMDP and CIBMTR, partner registries, participating Donor and HCT centers and the interested public.**

During the grant period, CIBMTR developed a long term Data and Information Management Strategy (IM Strategy) in order to improve our ability to provide quality information and data in a timely manner for the organization's researchers, analysts and management as well as various external stakeholders. This strategy builds on the success of our existing efforts in data collection through FormsNet and AGNIS, the maturity of the metadata curation process, near completion of legacy data consolidation initiatives.

The burden upon HCT centers of providing data to the CIBMTR is gradually increasing. Implementation of an electronic data capture system, FormsNet, is helpful as an interface to collect the data, provide better data validation at data entry to improve data quality, and to deliver work flow management tools to centers to improve accuracy, completeness and timeliness of data capture. However, this system does not measurably address the burden of data collection for centers.

Strategies to reduce burden of data collection for centers must include systems to automate the collection, synthesis and submission of data to the observational database. AGNIS has the opportunity to achieve this, however, it currently relies upon an up-front investment by HCT centers to map the standard data elements from their data systems to those of the CIBMTR. Though this investment is substantial, several centers are attempting to complete this work, and one center has successfully implemented the system. Several vendors are interested in developing software that integrates AGNIS mapping. However, small and medium centers are not likely to have the resources to invest in mapping to the AGNIS data standard.

Developing a BRIDG compatible data model and data standard has the distinct advantage of transforming AGNIS into HL7 v3 RIM compliance. HL7 is the standard ontology of Health IT, and represents the language by which Health IT is conducted, including most Electronic Medical Records. We anticipate that bringing the AGNIS system into HL7 compliance will open the opportunity for EMR providers to include HCT standard data elements into the EMR. Additionally, CIBMTR is developing an EMR working group to define a standard data collection template for interested centers to incorporate into the EMR as point-of-entry data collection of structured data elements which can be used to automate connect to AGNIS using HL7. Solutions such as these represent an opportunity to leverage the EMR to automate data collected in the process of patient care to populate the CIBMTR observational database. **The grant funding during this period advanced the effort to resolve this problem by sourcing resources on the following initiatives:**

Strategy Deliverables:

- All legacy data will be consolidated into FormsNet and the CIBMTR Observations databases. This reinforces the single source of truth principle to increase data integrity. (Scheduled for completion in 2011).
    - Consolidation of systems used for collection and storage prior to the FormsNet2 release in 2007.
- Map CIBMTR data elements into the BRIDG (Biomedical Research Integrated Domain Group) UML Model produces key advantages for:

- Reducing centers' burden in electronic submission
- Ensuring extensibility of the information management strategy
- Expanding the concepts of reusability and consistency in metadata analysis

- Produce a BRIDG-compatible model and database (with associated CDE's) covering the scope of federally-mandated data submission from all transplant centers to the Stem Cell Therapeutic Outcomes Database (SCTOD).
  - A pilot project is underway using the BRIDG-compatible model. This process of taking a UML model as the blueprint of a 3rd normal database has been done for a CIBMTR database called IIDB (Integrated Immunological Integrated Database) that contains data extracted from NMDP and the SCTOD. We are expanding the content of this database to include Infectious Disease Markers, HLA genetic information and HLA Match Grades. As a pilot, this database pulls data from FormsNet2, NMDP Recipient Legacy (prior to Nov 2007), Operational NMDP systems and the CIBMTR Observational databases.
  - Mapping of the remaining metadata elements for the HCT context of the caDSR defined by the CIBMTR (described above) to the BRIDG model is in progress. This model will be the basis for the CIBMTR data warehouse. Full development of the model will provide a universal data dictionary to the HCT community for improved data transmission, retrieval and analysis.
  - Create a production data mart for research and analysis. The pilot will evaluate tool suitability and implement from the suite of business intelligence tools introduced by the NMDP Enterprise Architecture Initiative for Information Delivery.
- Analyze CIBMTR research needs for information delivery and produce detailed stakeholder requirements, design and prioritized plan for implementing each subsequently defined data mart.

While work continues, further significant and timely progress is dependent on funding availability.

ACRONYM LIST

AABB	American Association of Blood Banks	HLA	Human Leukocyte Antigen
AFA	African American	HML	Histoimmunogenetics Mark-up Language
AGNIS	A Growable Network Information System	HR	High Resolution
AIM	Ancestry Informative Markers	HRSA	Health Resources and Services Administration
AML	Acute Myelogenous Leukemia	HSC	Hematopoietic Stem Cell
ABD	Antigen Binding Domain	IBWC	Immunobiology Working Committee
AERS	Adverse Event Reporting System	IDM	Infectious Disease Markers
API	Asian Pacific Islander	IHWG	International Histocompatibility Working Group
ARS	Acute Radiation Syndrome (also known as Acute Radiation Sickness)	IMGT	ImMunoGeneTics
ASBMT	American Society for Blood and Marrow Transplantation	IHIW	International Histocompatibility and Immunogenetics Workshop
ASHI	American Society for Histocompatibility and Immunogenetics	IPR	Immunobiology Project Results
B-LCLs	B-Lymphoblastoid Cell Lines	ICRHER	International Consortium for Research on Health Effects of Radiation
BARDA	Biomedical Advanced Research and Development Authority	IIDB	Integrated Immunological Data Base
BBMT	Biology of Blood and Marrow Transplant	IM	Information Management
BCP	Business Continuity Plan	IND	Investigational New Drug
BCPeX	Business Continuity Plan Exercise	IS	Information Services
BIG	Biomedical Informatics Grid	IT	Information Technology
BMCC	Bone Marrow Coordinating Center	IRB	Institutional Review Board
BMDW	Bone Marrow Donors Worldwide	JCAHO	Joint Commission on Accreditation of Healthcare Organizations
BMT	Bone Marrow Transplantation	KIR	Killer Immunoglobulin-like Receptor
BMT CTN	Blood and Marrow Transplant - Clinical Trials Network	MDACC	MD Anderson Cancer Center
BODI	Business Objects Data Integrator	MDS	Myelodysplastic Syndrome

BRIDG	Biomedical Research Integrated Domain Group	MHC	Major Histocompatibility Complex
BRT	Basic Radiation Training	MICA	MHC Class I-Like Molecule, Chain A
ca	Cancer	MICB	MHC Class I-Like Molecule, Chain B
C&A	Certification and Accreditation	MKE	Milwaukee
CAU	Caucasian	MRD	Minimal Residual Disease
CBMTG	Canadian Blood and Marrow Transplant Group	MSKCC	Memorial Sloan-Kettering Cancer Center
CBB	Cord Blood Bank	MSP	Minneapolis
CBC	Congressional Black Caucus	MUD	Matched Unrelated Donor
CBS	Canadian Blood Service	NAC	Nuclear Accident Committee
CBU	Cord Blood Unit	NCBM	National Conference of Black Mayors
CDA	Clinical Document Architecture	NCI	National Cancer Institute
CDE	Common Data Element	NEMO	N-locus Expectation-Maximization using Oligonucleotide typing data
CHTC	Certified Hematopoeitic Transplant Coordinator		
CIBMTR	Center for International Blood & Marrow Transplant Research	NHLBI	National Heart Lung and Blood Institute
CIT	CIBMTR Information Technology	NIH	National Institutes of Health
CLIA	Clinical Laboratory Improvement Amendment	NIMS	National Incident Management System
CME	Continuing Medical Education	NK	Natural Killer
CMF	Community Matching Funds	NLE	National Level Exercise
COG	Children's Oncology Group	NMDP	National Marrow Donor Program®
CREG	Cross Reactive Groups	NRP	National Response Plan
CSS	Center Support Services	NST	Non-myeloablative Allogeneic Stem Cell Transplantation
CT	Confirmatory Testing	OCR/ICR	Optical Character Recognition/Intelligent Character Recognition
CTA	Clinical Trial Application	OIT	Office of Information Technology
CTMS	Clinical Trial Management System	OMB	Office of Management and Budget
DC	Donor Center	ONR	Office of Naval Research
DHHS-ASPR	Department of Health and Human Service –	P2P	Peer-to-Peer

	Assistant Secretary Preparedness and Response		
DIY	Do it yourself	PBMC	Peripheral Blood Mononuclear Cells
DKMS	Deutsche Knochenmarkspenderdatei	PBSC	Peripheral Blood Stem Cell
DMSO	Dimethylsulphoxide	PCR	Polymerase Chain Reaction
DoD	Department of Defense	POC	Proof of Concept
DHHS-ASPR	Department of Health and Human Services – Assistant Secretary for Preparedness and Response	PSA	Public Service Announcement
DNA	Deoxyribonucleic Acid	QC	Quality control
DR	Disaster Recovery	RCC	Renal Cell Carcinoma
D/R	Donor/Recipient	RCI BMT	Resource for Clinical Investigations in Blood and Marrow Transplantation
EBMT	European Group for Blood and Marrow Transplantation	REAC/TS	Radiation Emergency Assistance Center/Training Site
EDC	Electronic Data Capture	REMM	Radiation Emergency Medical Management
EFI	European Federation of Immunogenetics	RFP	Request for Proposal
EM	Expectation Maximization	RFQ	Request for Quotation
EMDIS	European Marrow Donor Information System	RG	Recruitment Group
		RIN	RNA Integrity Number
EMR	Electronic Medical Records	RITN	Radiation Injury Treatment Network
ENS	Emergency Notification System	RNA	Ribonucleic Acid
ERSI	Environment Remote Sensing Institute	SBT	Sequence Based Typing
FBI	Federal Bureau of Investigation	SCTOD	Stem Cell Therapeutics Outcome Database
FDA	Food and Drug Administration	SG	Sample Group
FDR	Fund Drive Request	SLW	STAR Link® Web
FHIR	Fast Healthcare Interoperability Resources	SNP	Single Nucleotide Polymorphism
FLOCK	Flow Cytometry Analysis Component	SSA	Search Strategy Advice
FN	Forms Net	SSO	Sequence Specific Oligonucleotides
Fst	Fixation Index	SSP	Sequence Specific Primers
GETS	Government Emergency Telecommunications	SSOP	Sequence Specific Oligonucleotide Probes

	Service		
GCSF	Granulocyte-Colony Stimulating Factor (also known as filgrastim)	STAR®	Search, Tracking and Registry
GIS	Geographic Information System	TC	Transplant Center
GvHD	Graft vs Host Disease	TED	Transplant Essential Data
GTR	Genetic Testing Report	TNC	Total Nucleated Cell
HCS	HealthCare Standard	TSA	Transportation Security Agency
HCT	Hematopoietic Cell Transplantation	UI	User Interface
HEPP	Hospital Emergency Preparedness Program	UML	Unified Modeling Language
HHQ	Health History Questionnaire	URD	Unrelated Donor
HHS	Health and Human Services		
		VPN	Virtual Private Network
HIPAA	Health Insurance Portability and Accountability Act	WGA	Whole Genome Amplification
HIS	Hispanic	WMDA	World Marrow Donor Association
HL	Health Level	WU	Work-up